NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR (H.P.) - 177 005
B.Tech. End Semester Examination November-December 2022
2nd Year (3rd Semester)

Branch : Mechanical Engineering **Semester:** Third
Course name: Kinematics of Machines **Course Code:** ME-211
Time allowed: Three hours **Maximum marks:** 50
Date of exam: 01.12.2022 Session A (9:30-12:30 PM)
NOTE: Attempt all the questions which carry marks as indicated in the bracket.

I **(a)** Explain clearly giving examples of each, the kinematic pairs on various considerations.

(4)

(b) Draw a neat sketch of a single slider crank chain and its two inversions.

(2,2,2)

II **(a)** Discuss the three types of instantaneous centres for a four bar mechanism.

(3)

(b) The crank of a slider crank mechanism rotates at a constant speed of 300 r.p.m in clockwise direction. The crank radius is 150 mm and the connecting rod length is 600 mm. Determine :
i) linear velocity and acceleration of midpoint of the connecting rod and
ii) angular velocity and angular acceleration of the connecting rod at a crank angle of 45^0 from IDC position. Draw neat space, velocity and acceleration diagrams.

(1,3,3)

III **(a)** A leather belt is required to transmit 7500 W from a pulley of 1.2 m in diameter running at 250 r.p.m. The angle embraced is 165^0 and the friction coefficient between the belt and the pulley is 0.3. If the safe working stress for the belt is 1.5 MPa, density 1 Mg/m3 and thickness 10 mm, determine the width of the belt taking centrifugal tension into account.

(4)

(b) Draw neat sketches of the following:

i) Open belt drive ii) twist belt drive and iii) Compound belt drive

(2,2,2)

IV A cam is to be designed for a knife edge follower with the following data:

i) Cam lift of 40 mm during 90^0 of cam rotation with simple harmonic motion.
ii) Dwell for the next cam rotation of 30^0.
iii) During the next 60^0 of cam rotation, the follower returns to its original position with simple harmonic motion.
iv) Dwell during the remaining 180^0.

PTO

Draw neatly the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft. The radius of the base circle of the cam is 40 mm.

Also determine the maximum velocity and acceleration of the follower during its outstroke and return, if the cam rotates at 240 r.p.m.

(3,5,2)

V (a) Draw neat sketches of the following:

    i)   A simple gear train with one intermediate gear and
    ii)   A compound gear train

Also derive the expressions for the Speed ratio and Train value.   (4, 4)

    (b)   Write a note on the gear materials.   **(2)**

***END